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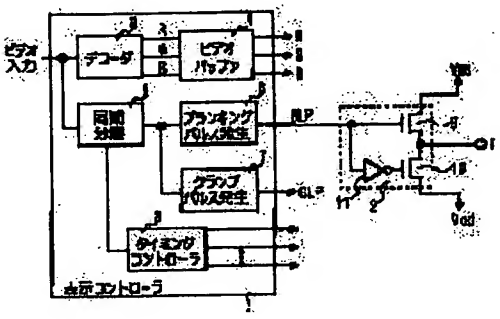
(54) ELECTROLUMINESCENCE DISPLAY DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To substantially prevent shortage of the life of an EL element caused by accumulation of space charges in the EL element generating by repeating current driving.
SOLUTION: In this EL display device having at least a hole transport layer and a luminescent layer between an anode and a cathode and emitting light by supplying a specified bias, a selecting circuit 2 for supplying voltage VBS higher than power source voltage supplying to the anode during driving and either one voltage of earthing voltage and negative voltage Vcd to the cathode is installed, and space charges accumulating in the element are periodically removed by applying reverse bias between the anode and the cathode during a non-display period.



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CLAIMS

[Claim(s)]
[Claim 1] The electroluminescence display characterized by applying a reverse bias between said anode plates and cathode at a non-display period in the electroluminescence display which emits light by having a hole transportation layer and a luminous layer at least, and supplying predetermined bias between an anode plate and cathode.
[Claim 2] When the pulse signal generated at a non-display period is inputted and this pulse signal is the 1st level, When the 1st potential for supplying said predetermined bias between said anode plates and cathode is impressed to said cathode or anode plate and said pulse signal is the 2nd level, The electroluminescence display according to claim 1 characterized by having the selection circuitry which impresses the 2nd potential for supplying said reverse bias between said anode plates and cathode to said cathode or anode plate.
[Claim 3] Said pulse signal is a electroluminescence display according to claim 1 or 2 characterized by being the blanking pulse signal or clamp pulse signal generated at a non-display period.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention has a hole transportation layer and a luminous layer at least between an anode plate and cathode, and relates to the electroluminescence display which emits light by supplying predetermined bias.
[0002]
[Description of the Prior Art] Since an organic EL device emits light itself, while it does not need a required back light with a liquid crystal display but is the the best for thin-shape-izing, in order that there may be no limit also in an angle of visibility, the utilization is greatly expected as a next-generation display.
[0003] As shown in drawing 7 , between the anode plate 51 which consists of transparent electrodes, such as ITO, and the cathode 55 which consists of a MgIn alloy, such an organic EL device carries out the laminating of the hole transportation layer 52 which consists of MTDATA, the luminous layer 53 which consists of TPD and Rubrene, and the electronic transportation layer 54 which consists of Alq3 to order, and is formed. And when the hole poured in from the anode plate 51 and the electron poured in from cathode 55 recombine inside a luminous layer 53, light is emitted, and as the arrow head in drawing shows, light is emitted to the exterior from a transparent anode plate side.
[0004] Two kinds, the passive mold of passive-matrix structure and the active mold which uses TFT, are shown in the indicating equipment which drives this organic electroluminescence, and the drive circuit shown in drawing 6 was conventionally used in the active mold.
[0005] In drawing 6 , 70 is an organic EL device. The drive circuit for 1 pixel TFT71 for switching which the status signal DATA from the display signal line 75 is impressed to a drain, and the selection signal SCAN from selection-signal Rhine 76 is impressed to the gate, and is turned on and off with a selection signal SCAN, The source of TFT71, and predetermined direct current voltage Vsc The capacitor 72 which is connected in between, is charged by the status signal supplied at the time of ON of TFT71, and holds the charge electrical potential difference VG at the time of OFF of TFT71, While connecting with power-source Rhine 77 to which a drain supplies the drive supply voltage Vdd and connecting the source to the anode plate of an organic EL device 70 It is constituted by TFT74 for a drive which carries out the current drive of the organic EL device 70 by supplying the maintenance electrical potential difference VG from a capacitor 72 to the gate. Moreover, the cathode of an organic EL device is connected to touch-down (GND) potential, and the drive supply voltage Vdd is usually forward potential called 10V. Moreover, an electrical potential difference Vsc is the same potential as Vdd, or touch-down (GND) potential.
[0006] As shown in drawing 7 , on the glass substrate 60, TFT74 for this drive carries out the laminating of the polish recon thin film 65 which has the gate electrode 61, gate dielectric film 62, the drain field 63, a channel field, and the source field 64, an interlayer insulation film 66, and the flattening film 67 to order, and is formed, and the drain electrode 68 with which the drain field 63 constitutes power-source Rhine 67 (refer to drawing 6), and the source field 64 are connected to the transparent electrode 51 which is an anode plate of an organic EL device.
[0007]
[Problem(s) to be Solved by the Invention] An EL element emits light by current drive, as mentioned above, at the time of a drive, a current flows toward cathode from an anode plate, and a current does

not flow at the time of un-driving. That is, since a current always flows only to an one direction, if a drive is repeated, space charge collects in [, such as between a hole transportation layer and luminous layers or between an electronic transportation layer and luminous layers] an EL element, and it has become the cause in which this shortens the life of an EL element. Especially, it is thought even in the inside in a component that space charge tends to collect between a hole transportation layer and a luminous layer. Such a technical problem is the same, even if a drive method is a passive mold and is an active mold.

[0008] Then, this invention aims at carrying out the current drive of the EL element so that a life can be lengthened as much as possible.

[0009]

[Means for Solving the Problem] This invention is characterized by applying a reverse bias between said anode plates and cathode at a non-display period in the electroluminescence display which emits light by having a hole transportation layer and a luminous layer at least, and supplying predetermined bias between an anode plate and cathode.

[0010] Moreover, when this invention inputs the pulse signal generated at a non-display period and this pulse signal is the 1st level, When the 1st potential for supplying said predetermined bias between said anode plates and cathode is impressed to said cathode or anode plate and said pulse signal is the 2nd level, It is characterized by having the selection circuitry which impresses the 2nd potential for supplying said reverse bias between said anode plates and cathode to said cathode or anode plate.

[0011] Moreover, in this invention, said pulse signal is characterized by being the blanking pulse signal or clamp pulse signal generated at a non-display period.

[0012]

[Embodiment of the Invention] Drawing 3 shows the circuitry of EL display panel used for EL display by this invention, and is the same configuration as the former fundamentally.

[0013] Namely, the drive circuit for 1 pixel which this configuration is an active mold which has two or more pixels, and drives an organic EL device 20 TFT21 for switching which the status signal DATA from the display signal line 25 is impressed to a drain, and the selection signal SCAN from selection-signal Rhine 26 is impressed to the gate, and is turned on and off with a selection signal SCAN, The source of TFT21, and predetermined direct current voltage Vsc The capacitor 22 which is connected in between, is charged by the status signal supplied at the time of ON of TFT21, and holds the charge electrical potential difference VG at the time of OFF of TFT21, While connecting with power-source Rhine 27 to which a drain supplies the drive supply voltage Vdd and connecting the source to the anode plate 201 of an organic EL device 20 It is constituted by TFT24 for a drive which carries out the current drive of the organic EL device 20 by supplying the maintenance electrical potential difference VG from a capacitor 22 to the gate.

[0014] And as usual, although the drive supply voltage Vdd is forward potential called 10V and an electrical potential difference Vsc is the same potential as Vdd, or touch-down (GND) potential, unlike the former, with this operation gestalt, the cathode 202 of an organic EL device 20 is connected to the terminal T which supplies at least good transformation instead of fixed potentials, such as touch-down (GND) potential.

[0015] It is the drain line which drawing 4 is the sectional view showing the structure of EL element 20 shown in drawing 3 , and TFT24 for a drive about two or more pixels, and consists of the aluminum to which 31 supplies a status signal DATA, supply-voltage Rhine which consists of the aluminum to which 32 supplies supply voltage Vdd, and the gate line which consists of the chromium with which 33 supplies a selection signal Scan, and the anode plate 201 of EL element 20 which 36 consists of TFT24 for a drive of drawing 3 , and 37 consists of ITO, and constitutes a pixel electrode expresses.

[0016] This TFT36 for a drive is the following, and is made and formed. First, the gate electrode 39 of chromium is formed on the transparent glass substrate 38, and gate dielectric film 40 is formed on it. Next, the polish recon thin film 41 was formed on gate dielectric film 40, this was covered upwards with the interlayer insulation film 42, and the drain line 31 and power-source Rhine 32 are formed. Furthermore, the laminating of the flattening insulator layer 43 is carried out, and the anode plate 37 which changes in ITO on it is formed. And power-source Rhine 32 is contacted in the drain

field of the polish recon thin film 41, and an anode plate 37 is contacted in a source field. Moreover, the structure of the switching TFT21 shown in drawing 3 is also the same as that of TFT36 for a drive, and the capacitor 22 connected to TFT21 consists of the chromium electrodes and polish recon thin films which sandwiched gate dielectric film.

[0017] Moreover, the anode plate 37 is separated and formed for every pixel on the flattening insulator layer 43, and the EL element is formed by carrying out the laminating of the hole transportation layer 44, a luminous layer 45, the electronic transportation layer 46, and the cathode 47 to order on it. And when the hole poured in from the anode plate 37 and the electron poured in from cathode 47 recombine inside a luminous layer 45, light is emitted, and as this light shows by the arrow head, it emanates to the exterior from a transparent anode plate side. Moreover, a luminous layer 45 is separated and formed in the almost same configuration as an anode plate 37 for every pixel, and each light of RGB emits light from each EL element by using a further different luminescent material for every RGB.

[0018] Here, Alq which MTDATA, Alq3, and a MgIn alloy are used, and contains a DCM system as a dopant as luminous layers 45 of R, G, and B as an ingredient of the hole transportation layer 44, the electronic transportation layer 46, and cathode 47, Alq which contains Quinacridone as a dopant, and the DPVBi system which contains a JISUCHIRIRU arylene system as a dopant are used.

[0019] By the way, to being formed independently for every pixel, as the anode plate 37 of an EL element was mentioned above, cathode 47 is formed in common to all pixels, as shown in drawing 4 . Of the top view shown in drawing 5 , cathode 47 is continuously formed in the whole surface so that still more clearly, the cathode material is extended as it is, and the connection terminal T with an external circuit is formed. The connection terminal T is connected with the connection terminal 49 which becomes with the copper formed in the rear face of the signal substrates 48, such as TAB and FPC, and is connected with an external circuit.

[0020] Next, the external circuit connected through the signal substrate 48 is explained, referring to drawing 1 and 2.

[0021] Drawing 1 is the circuit diagram showing the configuration of an external circuit, and consists of the display controller 1 and a selection circuitry 2. The decoder 3 which the display controller 1 decodes a video input signal, and outputs the video signal of R, G, and B in three primary colors, The video buffer 4 which carries out current amplification of the video signal from a decoder 3, and the synchronizing separator circuit 5 which separates a synchronizing signal from a video input signal, The blanking pulse generating circuit 6 and the clamp pulse generating circuit 7 which generate respectively a blanking pulse BLP and a clamp pulse CLP based on the separated synchronizing signal, It consists of the timing controller 8 which generates various kinds of timing signals used with an organic electroluminescence display panel based on the output of a synchronizing separator circuit 5.

[0022] It connects with the connection terminal T with which a selection circuitry 2 is connected with the cathode 202 (drawing 4 , 47 of 5) of EL element 20 where it connects with a serial, and is constituted, the end of TFT9 is connected to the reverse bias electrical potential difference VBS, the end of TFT10 is connected to the electrical potential difference Vcd of touch-down potential or negative potential, and TFT 9 and 10 of n channels shows the other end of TFT 9 and 10 to drawing 3 . A clamp pulse BLP is inputted into the gate of TFT9 as it is, and the reversal signal of a clamp pulse BLP is inputted into the gate of TFT10 through the inverter 11. Here, the reverse bias electrical potential difference VBS is set to the electrical potential difference higher than the supply voltage Vdd shown in drawing 3 , 20V [for example,].

[0023] As the video input signal inputted into the display controller 1 is shown in drawing 2 a, the display period and the non-display period are separated clearly, and a blanking pulse BLP is outputted to a non-display period, as shown in drawing 2 b. Moreover, a clamp pulse CLP is outputted as shown in drawing 2 c, and it is outputted to this and a non-display period. In addition, drawing 2 d is Horizontal Synchronizing signal Hsync detached a synchronized part.

[0024] Since a clamp pulse BLP is set to L level at a display period, this L level signal is inputted into the gate of TFT9, as shown in drawing 2 b, and H level signal which reversed L level signal is inputted into the gate of TFT10, TFT9 turns off and TFT10 turns on. Therefore, in a selection circuitry 2, the electrical potential difference Vcd of touch-down potential or negative potential is

outputted to the connection terminal T at a display period, and this electrical potential difference Vcd is supplied to the cathode 202 of all EL elements 20 through Terminal T. Since the anode plate 201 of all EL elements 20 is connected to the forward supply voltage Vdd through TFT24 for a drive as mentioned above, bias of the EL element is carried out to the forward direction, and the same current drive as usual is realized.

[0025] On the other hand, since it is set to H level at a non-display period, this H level signal is inputted into the gate of TFT9 and L level signal which reversed H level signal is inputted into the gate of TFT10, TFT9 turns on a clamp pulse BLP and TFT10 turns it off. Therefore, in a selection circuitry 2, the reverse bias electrical potential difference VBS is outputted to the connection terminal T at a non-display period, and this electrical potential difference VBS is supplied to the cathode 202 of all EL elements 20 through Terminal T. And since the electrical potential difference VBS is set as the electrical potential difference higher than supply voltage Vdd as mentioned above, an electrical potential difference higher than an anode plate 201 joins the cathode 202 of EL element 20, A reverse bias starts EL element 20.

[0026] Space charge will collect between the hole transportation layer 44 and a luminous layer 45 and between the electronic transportation layer 46 and a luminous layer 45, and EL element 20 will become the cause in which this shortens a life, if a current drive is repeated at a display period. However, with this operation gestalt, since a reverse bias starts EL element 20 at a non-display period, the space charge which collected between the hole transportation layer 44 and a luminous layer 45 and between the electronic transportation layer 46 and the luminous layer 45 will discharge. Especially, since a blanking pulse BLP is periodically outputted for every 1 level period in a non-display period, discharge of a charge is performed frequently and it can prevent that a charge collects as much as possible. Therefore, the life of EL element 20 can be lengthened.

[0027] In addition, although the blanking pulse BLP from the display controller 1 was inputted into the selection circuitry 2 instead, you may make it input other pulses outputted only in a clamp pulse CLP or a non-display period with this operation gestalt.

[0028] Moreover, although it was made to change the electrical potential difference which makes an anode plate fixed potential and is supplied to cathode by the selection circuitry with this operation gestalt, you may make it change the electrical potential difference which makes cathode fixed potential and is conversely supplied to an anode plate by the selection circuitry, and the electrical potential difference supplied to the both sides of an anode plate and cathode may be further changed by the selection circuitry.

[0029]

[Effect of the Invention] It can realize lengthening the life of an EL element, without affecting the drive in a display period in any way, since the space charge which collects in an EL element by repeating a current drive was made to discharge at a non-display period according to this invention.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the circuit diagram showing the external circuit configuration in the operation gestalt of this invention.
[Drawing 2] It is a timing chart for explaining actuation of the circuit shown in drawing 1 .
[Drawing 3] It is the circuit diagram showing the configuration of EL display panel in the operation gestalt of this invention.
[Drawing 4] It is the sectional view showing the structure of EL display panel in the operation gestalt of this invention.
[Drawing 5] It is the top view showing the structure of EL display panel in the operation gestalt of this invention.
[Drawing 6] It is the circuit diagram showing the configuration of the conventional EL display.
[Drawing 7] It is the sectional view showing the structure of the conventional EL display.
[Description of Notations]
1 Display Controller
2 Selection Circuitry
6 Blanking Pulse Generating Circuit
7 Clamp Pulse Generating Circuit
20 EL Element
21 TFT for Switching
24 TFT for Drive
201 37 Anode plate
202 47 Cathode
44 Hole Transportation Layer
45 Luminous Layer
46 Electronic Transportation Layer

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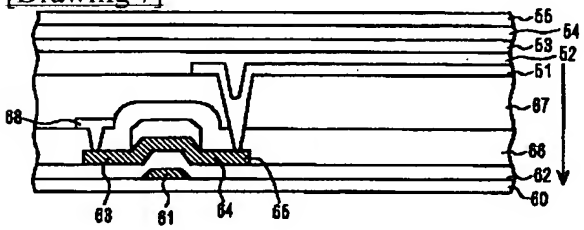
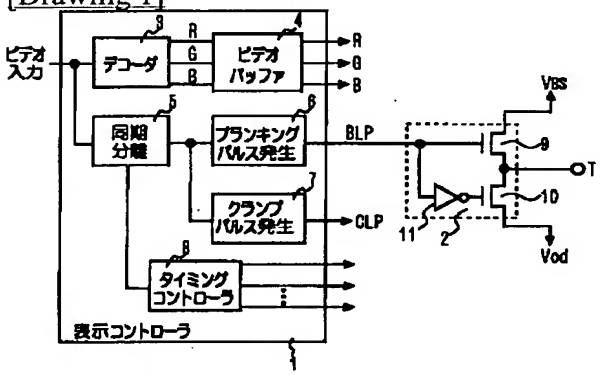
DRAWINGS

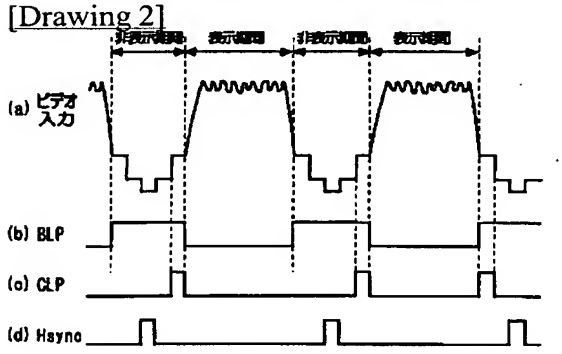
[Drawing 7]



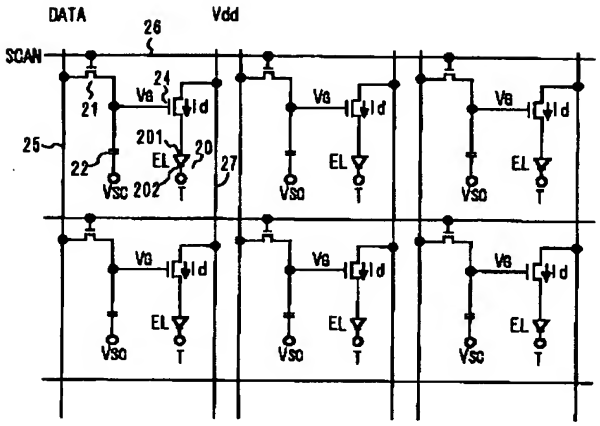
[Drawing 1]



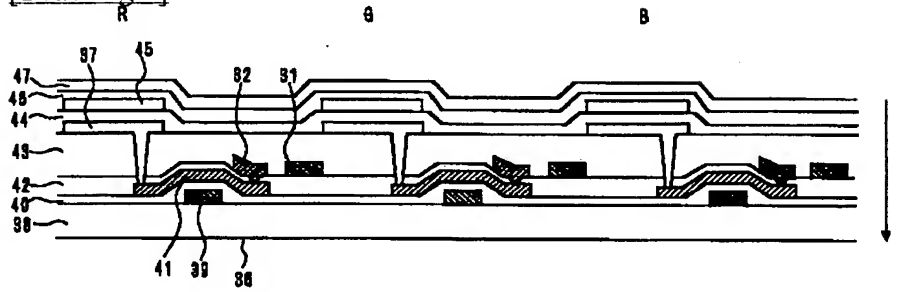
[Drawing 2]



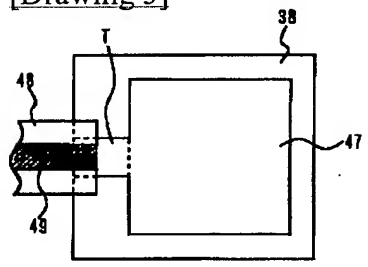
[Drawing 3]



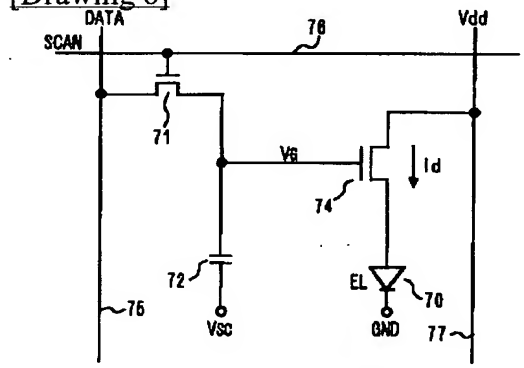
[Drawing 4]



[Drawing 5]



[Drawing 6]



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